



AD-A284 184

Overview

DTIC
S ELECIE D
SEP 02 1994
F

- Background/Purpose
- Scope/Method of Test
- Results
- Questions

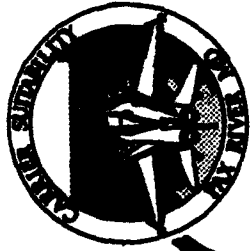
This document has been approved
for public release and sale; its
distribution is unlimited

94-28619

94 9 01 218



DTIC QUALITY INSPECTED 1



Background/Purpose

- In 1981, T-45 Training System selected to replace T-2C and TA-4J as Navy undergraduate jet trainer.
- Undergraduate jet trainer mission includes carrier qualification (CQ).
- Sea Trials testing performed to assess suitability for carrier operation in support of jet trainer mission.

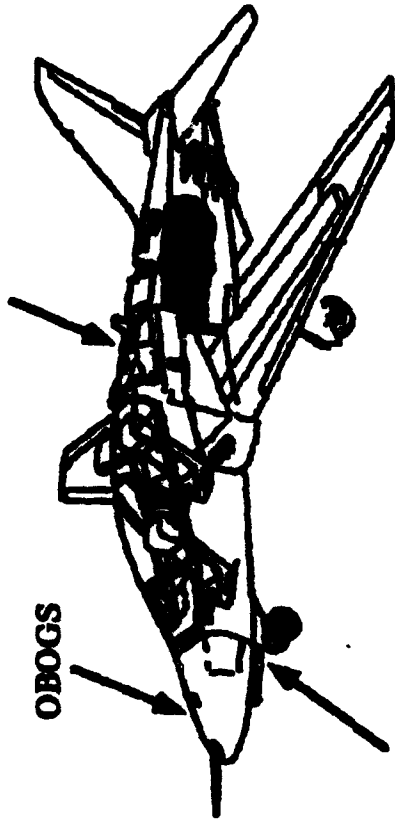




T-45A "Goshawk"

GTS

OBOGS



Nose tow launch
NWS
RRHB

| | |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Accession For | <input checked="" type="checkbox"/> NTIS <input type="checkbox"/> CRA&I <input type="checkbox"/> DTIC <input type="checkbox"/> TAB <input type="checkbox"/> Unannounced <input type="checkbox"/> Justification |
| By | <i>Dr. H. L.</i> |
| Distribution / | |
| Availability Codes | |
| Dist | A-1 |
| Avail and/or Special | |

Aircraft Type: Two-seat, single engine jet trainer
for the US Navy and Marine Corps

Fuel capacity: 3,000 lb

Features: Nose wheel steering

Gas Turbine Starter (GTS)

Prime Contractor: McDonnell Douglas Aerospace

On-Board Oxygen Generating System (OBOGS)

Repeatable Release Holdback Bar (RRHB)

Airplane Basic Weight: 10,300 lb

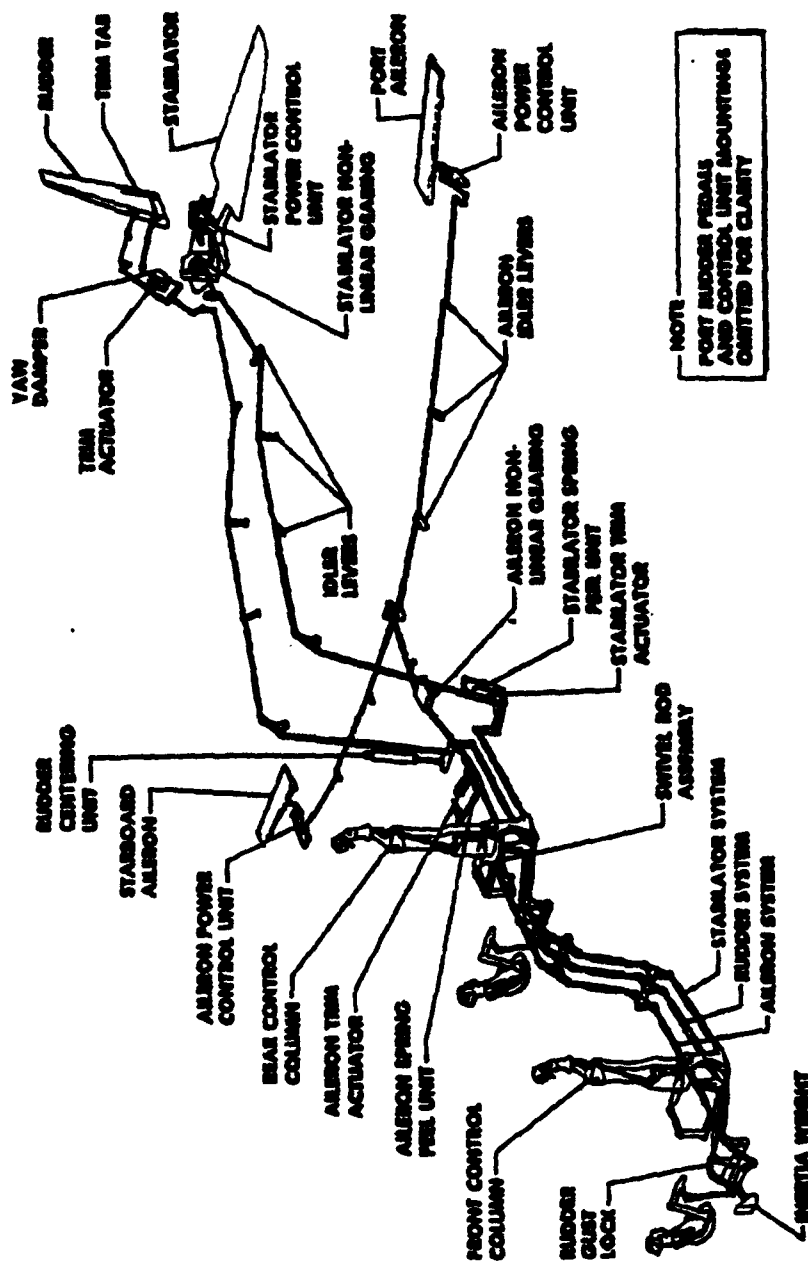
Max Arrested Landing Gross Weight: 13,400 lb

Max Catapult launch Gross Weight: 14,000 lb

Minimum WOD for recovery: -5 kt



T-45A "Goshawk"



NOTE—**FOOT MUDDER PEDALS AND CONTROL LINE MOUNTINGS OBTAINED FOR CLARITY**



Flight control system

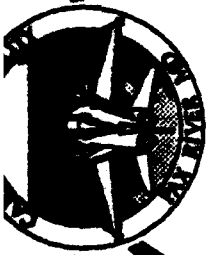


Scope of Test

Catapult Launch Tests

- Minimum End airspeed
- Longitudinal trim requirements
- Mis-trim characteristics
- Crosswinds





Scope of Test

Approach and Landing Tests

- Nominal and off-nominal approaches
- Waveoff and bolter performance
- Crosswinds
- Degraded mode (ARI/YDC off)





Scope of Test

Aircraft/Ship Compatibility

Taxi characteristics

Engine startup/shutdown

Post-arrestment cleanup

Elevator operations

EMC

Post-start/pre-shutdown checks

Tie down provisions

Catapult hookups

Towing operations

Maintainability

CV jacking



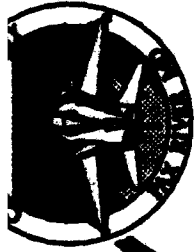


Method of Test

Minimum end airspeed

- Defined by 20 ft sink off bow
- Evaluated at two gross weights
- Launch technique and longitudinal trim established to maintain wings level and rotate to 15° AOA (0.9 Cl max)



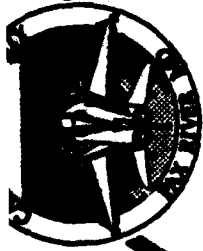


Method of Test

Longitudinal trim requirements

- Initial trim settings based on simulation and shorebased launches
- Less nose up trim required during shipboard catapult launch
- Optimum trim setting to obtain:
pitch rate < 12 deg/sec and AOA $< 15^\circ$
with acceptable flying qualities

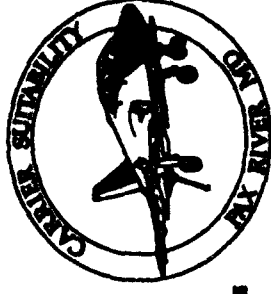


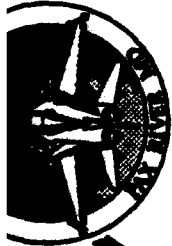


Method of Test

Crosswinds

- Tests performed to establish operational envelope to 15 kt
- Bow and waist catapults
- Clearance with ship structure critical during waist catapult operations.



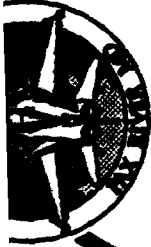


Method of Test

Nominal and off-nominal approaches

- Approaches with intentional deviations in glideslope, line-up and AOA.
- WOD range from 5 to 40 kt
- Approaches with ARI/YDC off.



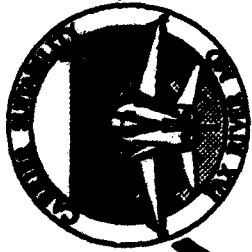


Method of Test

Waveoff and Bolter performance

- Waveoff performance evaluated for nominal and off-nominal glide slope and thrust conditions
- Bolter performance evaluated by moving aircraft touchdown point forward to 350 ft remaining.





Method of Test

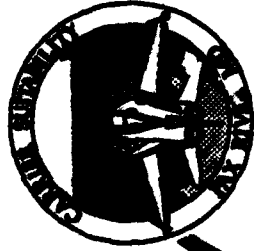
- **Crosswinds**

Aircraft handling qualities evaluated to 8 kt port and starboard crosswind.

- **Degraded mode (ARI/YDC off)**

Evaluate lineup control





Results

Minimum End Airspeed

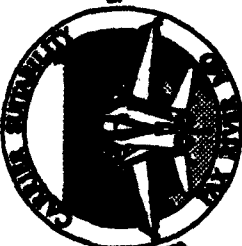
Initial Sea Trials (IST)

- “Stick free” technique
- Longitudinal and lateral stick motion

Follow-On Sea Trials (FOST)

- “Guarded stick” technique
- Longitudinal trim rotate to 15° AOA (0.9 Cl max) with pitch rates 7-9 °/s





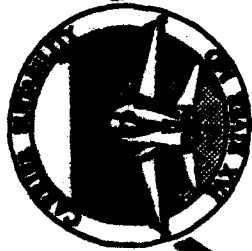
Results

- Minimum End Airspeed

| Gross weight (klb) | Airspeed (keas) | SOB (ft) |
|-----------------------|--------------------|-------------|
| 13.5 | 101 | 20 |
| 12.5 | 96 | 14 |

- Performance satisfactory





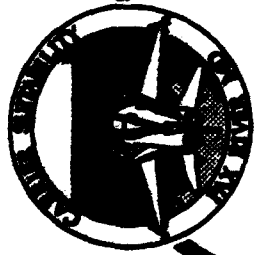
Results

Longitudinal Trim

IST

- Inconsistent stick motion
- Slight forward to full aft
- Pitch rates 11.5 to 17 °/s
- AOA to 18.5°





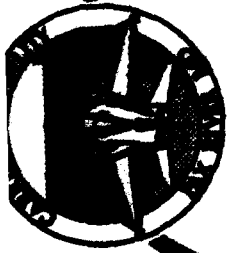
Results

Longitudinal Trim

FOST

- Acceptable pitch rate and flyaway AOA with 3.5° NU trim for CG range and excess end airspeed
- Longitudinal trim satisfactory
- Trim rate excessive (6 °/s)
- Stick interference in aft cockpit during wipeout



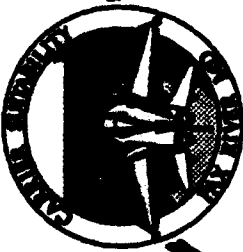


Results Crosswind Launch

FOST

- Bow and waist catapult launches with port and starboard crosswind to 15 kt satisfactory



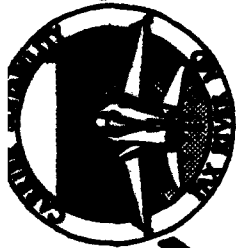


Results

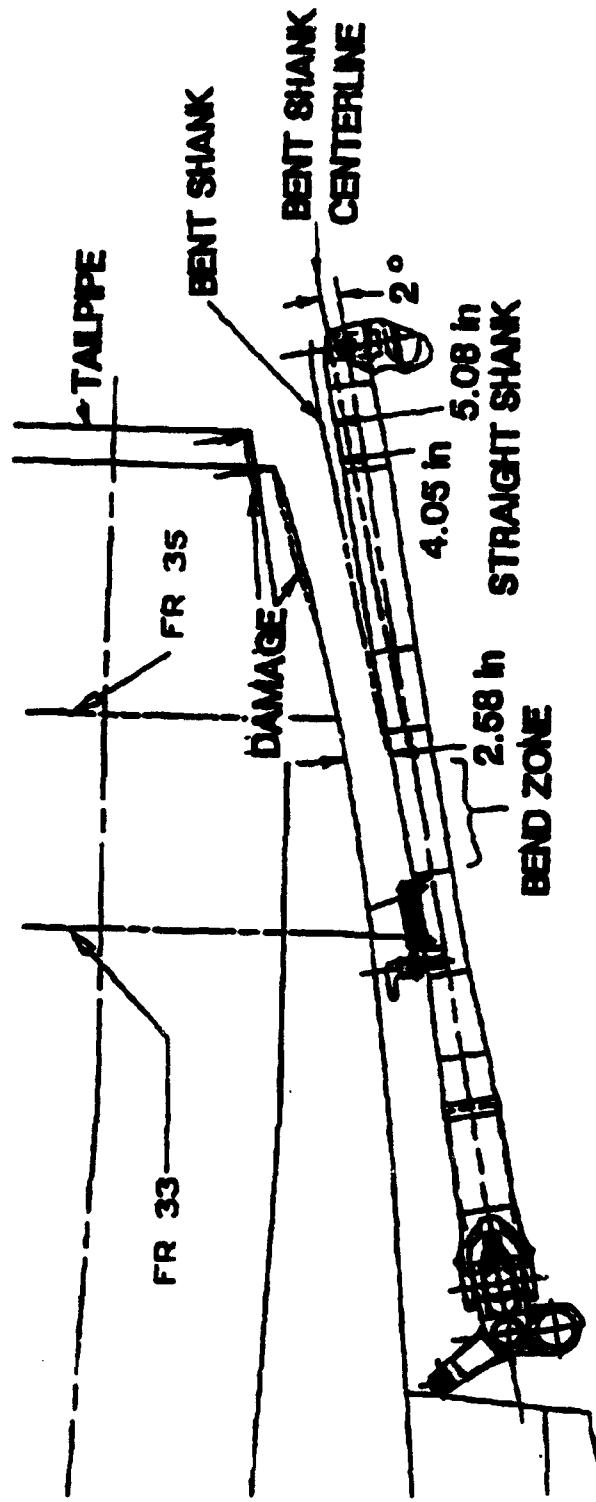
Approach and Landing Tests

- AOA control-satisfactory
- Approach airspeed-121 kcas at maximum landing weight
- Waveoff performance - satisfactory
- Bolter performance - satisfactory evaluated to 350 ft remaining
- Crosswinds up to 8 kt - satisfactory





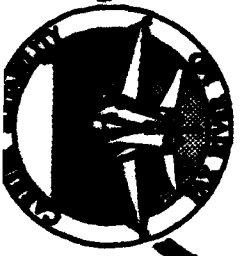
Results Arresting Hook Slap



GEOMETRY WITH BUMPER CONTACTING FUSELAGE AND NO LOADS

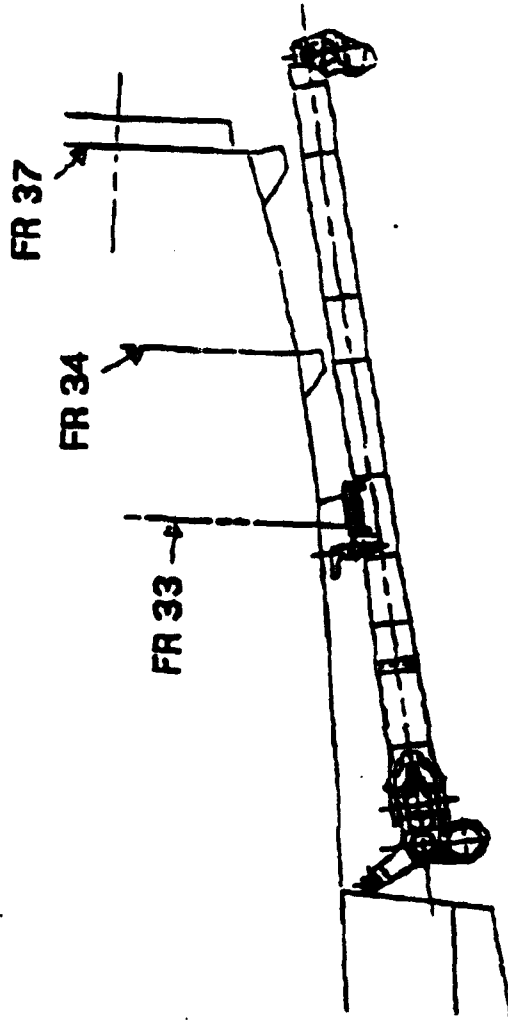
IST Configuration



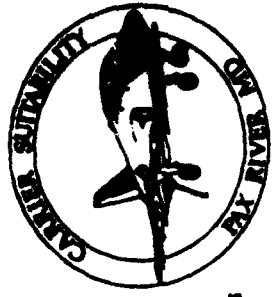


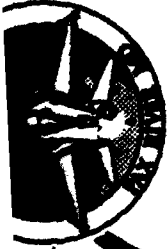
Results Arresting Hook Slap

- ADD BUMPER TO FR 34 AND FR 37.
- BEEFED UP TAILCOMB STRUCTURE
 - ADDED STEEL FRAMES
 - ADDED SKIN DOUBLERS AT NEW BUMPERS
 - REINFORCED AIRCRAFT ATTACHMENT STRUCTURE



FOST Configuration



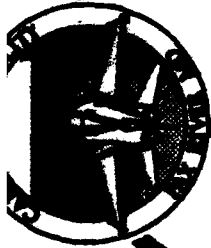


Method of Test

Mis-trim characteristics

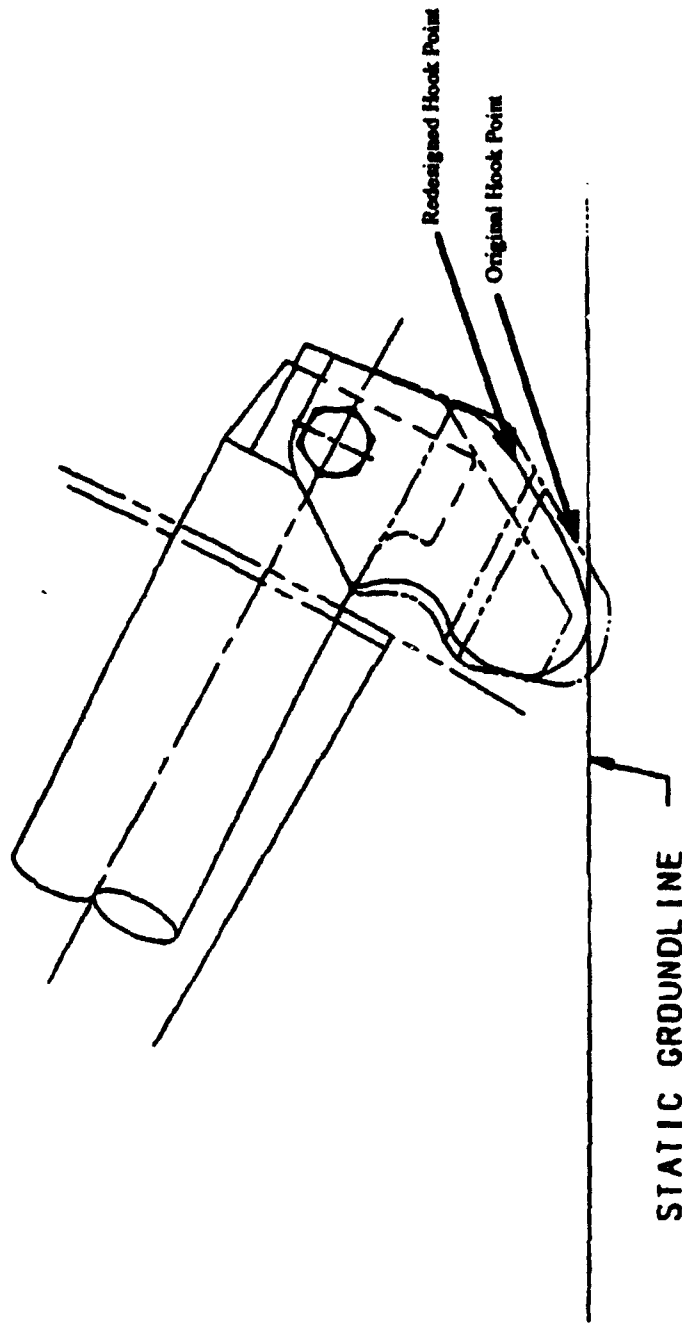
- Evaluate mis-trim effects on
 - pitch rate
 - AOA
 - sink off bow
- $\pm 1/2^\circ$ to $\pm 2^\circ$ mis-trim
- 10 to 40 kt excess
- Evaluate on bow and waist catapults





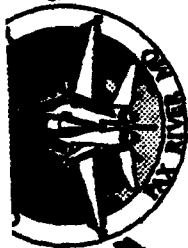
NAVAL AIR WARFARE CENTER AC DIV

Results Arresting Hook Slap



Follow-On Test Configuration

USN TPS Symposium



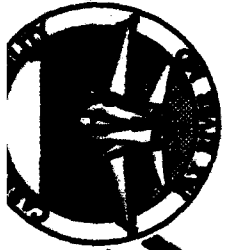
Results

Nose wheel steering (NWS)

IST

- NWS disengagements during flight deck taxi
- Slow NWS turn rate during flight deck taxi
- Imprecise NWS due to rudder pedal buffeting

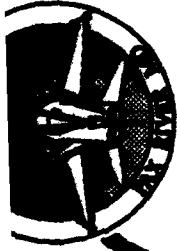




Conclusions

- T-45A airplane in compliance with the Test and Evaluation Master Plan (TEMP).
- T-45A airplane satisfactory for CQ phase of undergraduate jet trainer mission.





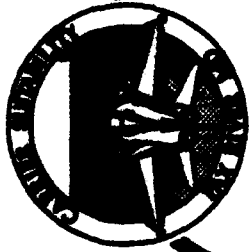
Results

Standard Attitude Heading Reference System (SAHRS)

FOST

- SAHRS failures during flight deck taxi
- Inaccurate heading information following shipboard alignment





Results

Nose wheel steering (NWS)

FOST

- NWS disengagements during flight deck taxi-corrected
- Slow NWS turn rate downgraded to Part II
- NWS disengagements due to EMI

